MASTER OF SCIENCE
IN
PHYSICAL OCEANOGRAPHY

ENVIRONMENTAL IMPACT ON MINE HUNTING IN THE YELLOW SEA USING THE CASS/GRAB MODEL

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The purpose of this work is to determine the necessity of a near real time ocean modeling capability such as the Naval Oceanographic Office's (NAVOCEANO) Modular Ocean Data Assimilation System (MODAS) model in shallow water (such as the Yellow Sea) mine hunting applications using the Navy's Comprehensive Acoustic Simulation System/Gaussian Ray Bundle (CASS/GRAB) model. Sound speed profiles inputted into the CASS/GRAB were calculated from observational (MOODS) and climatological (GDEM) data sets for different seasons and regions of four different bottom types (sand, gravel, mud, and rock). The CASS/GRAB model outputs were compared to the outputs from corresponding MODAS data sets. The results of the comparisons demonstrated in many cases a significant acoustic difference between the alternate profiles. These results demonstrated that there is a need for a predictive modeling capability such as MODAS to address the Mine Warfare (MIW) needs in the Yellow Sea region. There were some weaknesses detected in the profiles the MODAS model produces in the Yellow Sea, which must be resolved before it can reliably address the MIW needs in that region.

DoD KEY TECHNOLOGY AREA: Other (Military Environmental Factor)

KEYWORDS: Modeling and Simulation, Oceanography, MODAS, MOODS, GDEM, CASS/GRAB, NIDAS

A FINE RESOLUTION MODEL OF THE COASTAL EASTERN BOUNDARY CURRENT SYSTEMS OFF IBERIA AND MOROCCO

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To investigate the role of wind forcing, bottom topography and thermohaline gradients on classical as well as unique features in the northern Canary Current system (NCCS), four experiments are conducted with a sigma coordinate primitive equation model. The first experiment, which investigates the pressure gradient force error, shows that velocity errors inherent in three dimensional sigma coordinate models can be successfully reduced from ~1 m/s to less than 0.5 cm/s in the NCCS. The second experiment, which investigates the effect of annual wind forcing on a flat bottom, accurately portrays classical eastern boundary current features as well as unique NCCS features associated with a large embayment (i.e., the Gulf of Cadiz), poleward spreading of Mediterranean Outflow, and the generation of Meddies. The

additional effect of bottom topography in Experiment 3 shows that topography plays important roles in intensifying and trapping the equatorward current near the coast, in weakening the subsurface poleward current and in intensifying eddies off the capes of Iberia. The use of full instead of horizontally averaged thermohaline gradients in Experiment 4 highlights the development of the Iberian Current off the Portugal west coast, a feature not seen in the previous experiments. This shows that thermohaline gradients play an important role for the formation of the Iberian Current.

DoD KEY TECHNOLOGY AREAS: Battlespace Environments, Modeling and Simulation

KEYWORDS: Primitive Equation Model, Northern Canary Current System, Currents, Meanders, Eddies, Meddies, Filaments, POM, Sigma Coordinate